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10/828,437	04/21/2004	Shosuke Endoh	252112US2	5495

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EXAMINER	
DHINGRA, RAKESH KUMAR	
ART UNIT	PAPER NUMBER
1792	

NOTIFICATION DATE	DELIVERY MODE
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary	Application No.	Applicant(s)	
	10/828,437	ENDOH ET AL.	
	Examiner	Art Unit	
	RAKESH K. DHINGRA	1792	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *03* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *02 August 2007*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *4-8,11,13-15,18-27* is/are pending in the application.

4a) Of the above claim(s) *4-7,11 and 22-27* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *8,13-15 and 18-21* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *15 November 2006* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Response to Arguments

Applicant's arguments with respect to claims 8 and 12-21 have been considered but are moot in view of the new ground(s) of rejection as explained hereunder.

Applicant has amended claims 8, 18, 19 and 21, for example in claim 8 –new limitations "said groove is formed in said electrostatic chuck; said heat exchange means further comprises a supply path that supplies a heat transfer gas to said contact surface; and

said controller controls a pressure of the heat transfer gas supplied from said heat exchange means and changes the pressure of the heat transfer gas supplied in accordance with each of multiple steps of the plasma process" have been added.

Further, applicant has cancelled claims 12, 16 and 17.

Accordingly claims 4-8, 11, 13-15 and 18-27 are pending out of which claims 8, 13-15 and 18-21 are presently active.

New references by (US 6,373,681 – Kanno et al) and (US 5,491,603 – Birang et al) when combined with Koshiishi et al and Howald et al read on amended claim 8 limitations. Accordingly claims 8, 13-15 and 18-20 have been rejected under 35 USC 103 (a) as explained below. Further, remaining claim 21 has also been rejected under 35 USC 103 (a) as explained below.

Responding to applicant's argument that Howald et al does not provide a focus ring and therefore does not suggest/disclose changing chuck voltage of attracting a focus ring in accordance with each of sequences of the plasma process, examiner states that Koshiishi et al teach a focus ring 12 that is attracted to the electrostatic chuck by DC voltages applied from power source 15 through a controller 25. Further Howald et al teach supply of voltage from a DC power source 38 to an electrostatic chuck 30 and where the voltage is controlled by a computer system 64 (controller) using a stored program which causes the microprocessor 66 to control DC voltage source 38 to supply a sequence of time spaced step voltages

during processing of substrate (that is, as per multiple sequence of process steps). It would be obvious to use a controller as taught by Howald et al that controls the chucking voltage as per sequence of process steps as taught by Howald et al in the apparatus of Koshiishi et al to enable control the temperature and adhesion of the focus ring to the electrostatic chuck and obtain uniform processing over the entire surface of the substrate.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 8, 13-15, 18-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Koshiishi et al (US PGPUB No. 2003/0106647) in view of Kanno et al (US 6,373,681), Howald et al (US Patent No. 6,125,025) and Birang et al (US 5,491,603).

Regarding Claim 8: Koshiishi et al teach a plasma processing apparatus (Figures 1, 4) comprising:

a susceptor 11 having an electrostatic chuck (through dielectric films 14a, 14b) on which is mounted a wafer W that is subjected to plasma processing and a focus ring 12 having a contact surface is disposed in contact with said electrostatic chuck around a periphery of wafer W, the focus ring 12 is mounted on the electrostatic chuck having a chucking device 11a, 11b to which a DC voltage 15 is applied and the focus ring is attracted by electrostatic attraction to the electrostatic chuck by the chucking voltage applied to the chucking device 11a, 11b;

a heat exchange means provided at the said contact surface for carrying out heat exchange with the focus ring 12, the heat exchange means comprising an opening (in the dielectric layer 14b for the heat transfer gas coming through passage 17) and filled with heat transfer medium, and further comprising a supply path (connecting portion of supply path 17 to the focus ring 12) that supplies a heat transfer gas to said contact surface [e.g. Figs. 1, 4 and para. 0038, 0043).

Koshiishi et al further teach that for attracting the wafer and the focus ring, different voltages are applied from power supply 15 through switch 24 that is controlled by a switch controller 25 (a controller) as per sequence of processing of wafer (that is supply of voltage to chucking electrode 11a, for chucking the substrate is controlled by a controller) [paragraphs 0055-0059].

Koshiishi et al do not explicitly teach the heat exchange means comprising a groove in the electrostatic chuck, and also do not teach that the controller sets the chuck voltage applied to the chuck device high during at least one processing sequence, and said controller controls the chucking voltage with each of multiple sequence of plasma process, and the controller also controls a pressure of the heat

transfer gas supplied from said heat exchange means and changes the pressure of the heat transfer gas supplied in accordance with each of multiple steps of the plasma process.

Koshiishi et al teach the heat exchange means comprises an opening in the contact surface, but not teach a groove. However provision of grooves as a part of heat exchange means in electrostatic chucks is known in the art as per reference cited hereunder.

Kanno et al teach a plasma apparatus comprising an electrostatic chuck 10 for supporting a wafer and where the electrostatic chuck has plurality of concentric grooves provided on its top surface, so that the attracting areas on the positive and negative electrode sides change depending on the size and shape of the dispersion groove or recess, and that a residual attracting force is generated (e.g. Fig. 1, 2 and col. 2, lines 45-65 and col. 8, line 15 to col. 9, line 40). Though Kanno et al do not explicitly teach such groove formed on the contact surface between the focus ring and the electrostatic chuck, it would be obvious to provide similar groove in the apparatus of Koshiishi et al to increase the attraction force of focus ting to the electrostatic chuck, as per teaching of Kanno et al.

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to provide the electrostatic chuck with groove at the contact surface as taught by Kanno et al in the apparatus of Koshiishi et al to obtain increased attraction force between the focus ring and the electrostatic chuck.

Koshiishi et al in view of Kanno et al do not teach the controller sets the chuck voltage applied to the chuck device high during at least one processing sequence, and said controller controls the chucking voltage with each of multiple sequence of plasma process, and the controller also controls a pressure of the heat transfer gas supplied from said heat exchange means and changes the pressure of the heat transfer gas supplied in accordance with each of multiple steps of the plasma process.

Howald et al teach a plasma processing apparatus comprising an electrostatic chuck 30 mounted in chamber 10 and connected to a programmed DC power source 38 for processing a substrate 32.

Howald et al further teach that during initial processing of workpiece 32, voltage at terminal 40 is 5000 volts (high) and subsequently during processing the voltage reduces with respect to point 42. Howald et al also teach that supply of voltage from DC power source 38 is controlled by a computer system 64 (controller) using a stored program which causes the microprocessor 66 to control DC voltage source 38 to supply a sequence of time spaced step voltages during processing of substrate (that is as per multiple sequence of process steps). Howald et al additionally teach that DC power source voltage is also varied in response to flow sensor 70 to maintain constant chucking force (e.g. Fig. 1 and col. 9, line 5 to col. 17, line 10). Additionally Howald et al also teach a pressure sensor (not shown in Figures) that is responsive to the gas pressure exerted by the helium gas on the back face of substrate 32 and which (the pressure sensor), in combination with microprocessor 66 and flow sensor 70 enables controls the pressure of the helium gas supplied to valve 35 and line 34. It would be obvious to use a controller as taught by Howald et al, that controls the chucking voltage during multiple sequence of process steps, in the apparatus of Koshiishi et al in view of Kanno et al to obtain control of chucking voltage and the temperature of the substrate during processing.

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to use a controller that sets the chuck voltage applied to the chuck device high during substrate processing sequences as taught by Howald et al in the apparatus of Koshiishi et al in view of Kanno et al to obtain desired clamping force and temperature control of the substrate during processing steps.

Koshiishi et al in view of Kanno et al and Howald et al do not explicitly teach the controller changes the pressure of the heat transfer gas supplied in accordance with each of multiple steps of the plasma process.

Birang et al teach a plasma apparatus comprising a heat exchange gas system for an electrostatic chuck that includes a pressure transducer 240, a flow controller 230 and a controller 250. Birang et al

further teach that the controller 250 enables control of pressure of helium gas during various process steps like processing, de-chucking etc (e.g. Fig. 2 and col. 6, line 40 to col. 8, line 45).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to use a controller that controls the pressure of the heat exchange gas during processing steps as taught by Birang et al in the apparatus of Koshiishi et al in view of Kanno et al and Howald et al to obtain temperature control of the focus ring and the substrate and obtain uniform of substrate over the entire diameter.

Regarding Claim 13: Kanno et al teach the depth of groove is 0.3 mm (meets the claim limitation of not less than 0.1 mm) [col. 9, lines 30-41].

Regarding Claim 14: Kanno et al teach the gas groove is formed in such a shape that a heat transfer gas for promoting cooling of a wafer during processing effectively flows over the entire back surface of the wafer and the groove pattern is capable of giving a desired temperature distribution to the wafer during processing (col. 18, lines 18 -45).

Regarding Claim 15: Kanno et al teach the grooves comprise annular shape concentric with cover 22 (focus ring) [Fig. 2].

Regarding Claim 18: Koshiishi et al teach an electrode 11b built into the chuck device that faces the focus ring 12 (Figure 4).

Regarding Claims 19, 20: Claim limitations reciting heat exchange means reducing temperature of focus ring to at least 20 degrees C below a temperature of the electrostatic chuck, and to a temperature not more than 0 degrees C are functional limitations, and since the apparatus of prior art meets the structural limitations of the claim, the same is considered capable of meeting the functional limitations.

In this connection courts have ruled:

Claims directed to apparatus must be distinguished from the prior art in terms of structure rather than function. *In re Danly*, 263 F.2d 844, 847, 120 USPQ 528, 531 (CCPA 1959). Apparatus claims cover

what a device is, not what a device does *Hewlett-Packard Co. V. Bausch & Lomb Inc.,* 15USPQ2d 1525, 1528 (Fed. Cir. 1990)

Claim 21 is rejected under 35 U.S.C. 103(a) as being unpatentable over Koshiishi et al (US PGPUB No. 2003/0106647) in view of Kanno et al (US 6,373,681), Howald et al (US Patent No. 6,125,025) and Birang et al (US 5,491,603) as applied to Claims 8, 13-15 and 18-20 and further in view of Huang (US PGPUB no. 2004/0005726).

Regarding Claim 21: Koshiishi et al in view of Kanno et al, Howald et al and Birang et al teach all limitations of the claim except that heat exchange medium reduces temperature of focus ring to at least below 20 degrees C below the temperature of electrostatic chuck.

Huang teach an apparatus that includes an electrostatic chuck 16 with a temperature controlled focus ring 52 having heat transfer means 54. Huang further teach that the apparatus comprises heat transfer means that can heat the focus ring (e.g. Fig. 3 and para. 0041).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to provide heating mean for heating the focus ring using as taught by Huang in the apparatus of Koshiishi et al in view of Kanno et al, Howald et al and Birang et al to enable control the temperature of the focus ring and control plasma density at the edge of the substrate s per process limitations like amount of radicals to be adsorbed by the focus ring (para. 0042).

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to RAKESH K. DHINGRA whose telephone number is (571)272-5959. The examiner can normally be reached on 8:30 -6:00 (Monday - Friday).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Parviz Hassanzadeh can be reached on (571)-272-1435. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Rakesh K Dhingra/
Examiner, Art Unit 1792

/Karla Moore/
Primary Examiner, Art Unit 1792